July 24, 1962 L. H. BARRON 3,046,204

METHOD FOR MAKING DIAMOND TOOLS

Filed Aug. 2, 1957

FIG. 1.

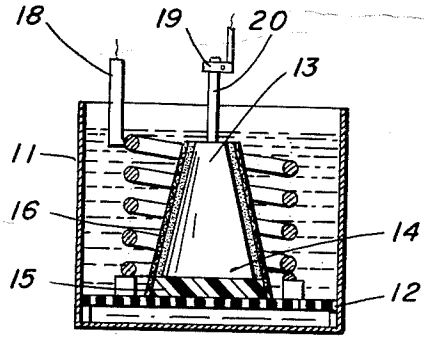


FIG. 2.

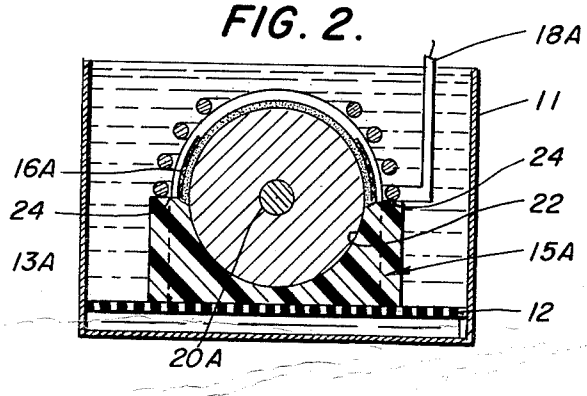
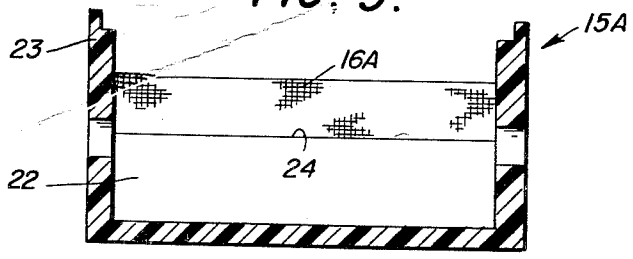


FIG. 3.



INVENTOR

LEE H. BARRON

BY

Myron R. Hartman

ATTORNEY

United States Patent Office 3,046,204 Patented July 24, 1962

3,046,204

METHOD FOR MAKING DIAMOND TOOLS

Lee H. Barron, 817 S. Maryland, Glendale, Calif.

Filed Aug. 2, 1957, Ser. No. 675,895
3 Claims. (Cl. 204—16)

This invention relates to a new method for forming diamond surfaced tools.

In the preparation of tools having diamond grits held or "set" on the surfaces of the tools, it has been customary to electroplate nickel on the surface to hold the properly spaced diamond grits in place. In the prior art, several methods have been developed for temporarily holding individual diamond particles or grits in spaced relation on the surface of the mandrel, following which a metal coating is put around and over the positioned diamonds so that the final cutting surface of the tool consists of separated diamond particles set or fully embedded in a matrix of metal, such as the electroplated nickel.

The principal object of this invention is to provide an economical process for anchoring a dense aggregated diamond grit coating on large mandrels, or on mandrels with vertical or nearly vertical surfaces.

In my method, an excess of the diamond particles is placed adjacent the surface of the mandrel as a compact mass or aggregate, following which nickel is electroplated at the surface of the mandrel and in the interstices between the particles adjacent the mandrel surface to anchor the aggregated coating of diamonds to the mandrel. Sometimes the thickness of the anchored aggregate is small, being of the order of a few thousandths of an inch, while on other tools, the attached aggregate may be considerably thicker.

For small tools and relatively flat surfaces, prior to the electroplating step, the diamond grits have simply been piled up on the surface in a reposed layer thicker than desired in the finished tool. As this art has developed, it has become necessary to coat larger and larger tool mandrels with diamond grits. The problem of covering large tool surfaces, including vertical surfaces, with an excess of diamond grits during the process of attaching them has become increasingly difficult because of the actual scarcity in the market of sufficient diamond grits and the heavy money investment required. The problem is particularly acute when the mandrel is of such shape that in order to bury it or a portion of it, some part of the mass of diamond grits must be excessively thick, with the grits merely in repose thereon, thus requiring an abnormal amount of diamond grits. The even distribution of the electrodepositing current also becomes difficult under these conditions.

I have discovered that a stainless steel wire mesh basket or partition made to conform more or less to the contour of the mandrel or the portion of the mandrel to be coated may be used to hold a more or less uniform thickness of compacted diamond grits in contact with the surface of the mandrel where it is to be coated, following which the electrodeposition of nickel onto the mandrel may be effected, with the mandrel as the cathode, and a suitable nickel coil outside the screen basket or partition as the anode. The stainless steel screen is preferably about 180 mesh and is electrically insulated from the anode and from the mandrel. It has been found that the use of this stainless steel screen as a temporary holder for the diamond grits during the process of attaching them to the mandrel greatly improves the quality of the electroplate of nickel which holds the diamond aggregate to the mandrel. It appears that the distribution of the nickel is much more uniform when the depositing current passes through this screen. In addition to this advantage of improved quality, there is the previously mentioned advantage of minimizing the amount of diamond grits to adequately cover the portion of the mandrel to be coated. Furthermore, in certain mandrel shapes it is necessary to coat one portion in one operation, followed by forming a connecting coating on adjoining surfaces, and when the wire screen is used, as described, it is possible to make a joint of uniform thickness between the two portions of the coating.

The method is illustrated by its application to the coating of two types of mandrels which have some surfaces to be diamond coated which are inclined at angles so steep that diamond grits may not be reposed thereon. In FIG. 1 is represented the arrangement used for diamond coating a truncated cone tool mandrel. An electroplating tank **11**, open at the top, is provided with a platform **12** to support the mandrel and basket, which are immersed in the electroplating solution. The truncated conical mandrel **13** stands upon its large end **14** on the basket base plate **15** to whose peripheral edge is attached a stainless steel wire screen **16**, which is formed into a cone displaced a short distance from the peripheral surface of the mandrel **13**. Diamond grits are packed as an aggregate between the surface of the mandrel **13** and the inside surface of the wire screen **16**. The anode **18** consists of an open metal coil disposed adjacent to but outside the conical wire screen **16**, the anode being connected electrically to the source of electrical current. A clamp **19** connects the other electrical conduit to the shaft **20** for the mandrel **13**, which becomes the cathode. The electrolyte consists of an aqueous solution having about 10 pounds of nickel sulfate, 1.9 pounds of nickel chloride, and 1.25 pounds of boric acid dissolved in 5 gallons of distilled water. This electrolyte is placed in the tank so as to cover the object to be plated. Pure nickel is then electroplated through the wire screen basket **16**, embedding and more or less enveloping the diamond grits held therein, this coating being on the average from about .002 inch to .04 inch in thickness, depending upon the grit sizes and other factors. The electroplating current is applied for a long period of 8 to 10 hours at a low current density. When the electroplating operation is completed, the basket **16**, including the base plate **15**, is lifted from the plating tank, and the loose, unattached diamond particles are recovered after disengaging the wire screen **16**. It will be clear that the basket or wire screen may be shaped to generally conform to the particular contour of the mandrel which is to be coated with diamonds, so that a mass of excess diamond grits is held against the mandrel surface during the electroplating. The base plate and the screen constituting the basket are conveniently assembled and held together by waterproof pressure-sensitive tape or the like so that it can be easily dismantled and re-assembled.

Another problem of electroplating diamond grits on a cylindrical mandrel is solved by the half cylindrical basket or jig arrangement shown in FIGS. 2 and 3. FIG. 2 represents the jig in place in an electroplating tank, the mandrel in this case being a cylinder whose axis is disposed horizontally. The jig in this case consists of a base **15A**, preferably made of transparent plastic such as Lucite, having a half cylindrical cavity **22** which accurately fits one half of the mandrel. The mandrel **13A** is placed in this cavity, being held in place by a shaft **20A** which extends through the Lucite ends **23** of the jig. The upper half of the mandrel is covered by a mass of diamond grits of substantially uniform thickness, held to the surface of the half cylinder by a stainless steel wire screen **16A**, extending from the shoulder **24** toward the upper portion of the periphery of the mandrel but not completely covering it. The diamond grits are packed in the space between the mandrel and the wire screen **16A** ex-

cept in that portion above the upper edges of the wire screen, where the diamond grits repose on the mandrel itself. Outside the wire screen 16A is provided anode 18A, the cathode being the mandrel itself, which is connected through the shaft 20A to the other electrical terminal. A similar nickel plating solution is provided in the plating tank 11, and the diamond grits are anchored to the upper half of the mandrel by the electroplate of nickel. The mandrel is then turned, and the other half coated in the same manner. FIG. 3 shows the jig itself with the wire screen attached to the Lucite base and ends.

The advantages of my invention will be apparent from the above description. The quality of the nickel electroplate is uniform because the "throw" of nickel in the electroplating operation is more uniform. The quantity of diamond grits required to "cover" large mandrels with near vertical surfaces is greatly reduced. Large mandrels may be coated in sections.

I claim:

1. The method of attaching a coating of diamond grits of multigrit thickness to portions of a metal tool form comprising the steps of supporting said tool form in a nickel plating bath with said tool form serving as cathode; interposing a formed basket of fine-wire mesh between said tool form and an electroplating anode, the wire mesh of said basket being adjacent to and electrically insulated from said tool form and said anode; filling the space between said tool surface and said basket with loose diamond grits; electroplating a nickel anchoring deposit in the interstices between said diamond grits and on said tool form surface to form a layer of multigrit thickness, the electroplating anode being external to said basket; and removing said basket and excess unattached diamond grits after said electroplating.

2. In the method of attaching a coating of diamond grits of multigrit thickness to portions of a metal tool form by an electroplate of nickel, the steps comprising supporting a compact layer of diamond grits in contact with said tool form by means of a foraminous stainless steel basket enclosing said grits but out of electrical contact with said tool form; electroplating a nickel anchoring deposit in the interstices between said diamond grits and on said tool form surface to form a layer of multigrit thickness whereby less than all of said compact layer of diamond grits is attached to said tool surface, said tool surface serving as cathode, and the electroplating anode being external to said basket; and then removing said basket and excess unattached diamond grits after said electroplating.

3. In the method of attaching a coating of diamond grits of multigrit thickness to portions of a metal tool form by an electroplate of nickel, the steps of holding a layer of diamond grits against said tool form in a nickel plating bath by forming an enclosing basket of fine-wire stainless steel mesh adjacent to but electrically insulated from the portion of said tool surface to be coated with diamond grits, with said diamond grits filling the space between said tool surface and said basket; electroplating an anchoring deposit of nickel in the interstices between said grits and on said tool portion surface to form a layer of multigrit thickness within said basket, said tool surface serving as cathode; and removing said basket.

References Cited in the file of this patent

UNITED STATES PATENTS

2,011,328	Tuttle	Aug. 13, 1935
2,194,546	Goddu et al.	Mar. 26, 1940
2,194,551	Holman	Mar. 26, 1940
2,360,789	Seligman et al.	Oct. 17, 1944
2,411,867	Brenner	Dec. 3, 1946
2,424,140	Beecher	July 15, 1947
2,578,167	Bjorklund et al.	Dec. 11, 1951
2,583,101	Oliver	Jan. 22, 1952
2,745,798	Haueisen et al.	May 15, 1956
2,784,151	Topellan	Mar. 5, 1957

FOREIGN PATENTS

128,448	Germany	Feb. 22, 1902
1,127,248	France	Jan. 22, 1952